Lunar Reconnaissance Orbiter (LRO) Observations with the Lunar Exploration Neutron Detector (LEND): Neutron Suppression Regions (NSR) and Polar Hydrogen

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Introduction: Orbital detection of neutrons has become the dominant remote sensing technique for detecting and inferring H concentrations and its spatial distribution beneath planetary surfaces [Lawrence et al, (2010) *Icarus*, 205, pp. 195-209, Mitrofanov et al (2007) *Science* 297(5578), 78-81].

Indications for the presence of localized and relatively high water content was provided by LRO and LCROSS. LEND identified *Cabeus*, as the most promising LCROSS impact site [Mitrofanov I. et al. (2010) *Science, 330*, 483], and instruments onboard LRO and LCROSS have measured signatures of water, H_2 and other volatiles in the impact plume [Colaprete A. et al. (2010) *Science, 339*, 463, Gladstone R. et al. (2010) *Science, 330*, 472].

Neutron Suppression Regions (NSRs), as potential locations of polar Hydrogen. Currently available LEND neutron data has identified localized *Neutron Suppression Regions*, or NSRs. The *Cabeus* NSR has a total area of about 700 km^2 (see Figure 1, *top*. Another well-observed NSR with an area about 1500 km^2 was detected within the polar crater known as *Shoemaker* (*middle*). The third example (*bottom*) of a well-defined NSR is the northern polar crater *Rozhdestvesnky*.

The LEND data do not support a model that suggests PSRs are the sole traps of water molecules from the lunar exosphere. Paige et al. (2010) [*Science, 330*, 479] has shown that a layer of water-rich permafrost may exist below a thin upper-most layer of dry regolith even under conditions of solar irradiation. Also, based on analysis between LOLA and LEND, poleward-facing slopes on the Moon display a predominantly stronger neutron suppression in comparison with equator-facing slopes [McClanahan T. et al. (2011) Abstract #1970 of 42th LPSC].

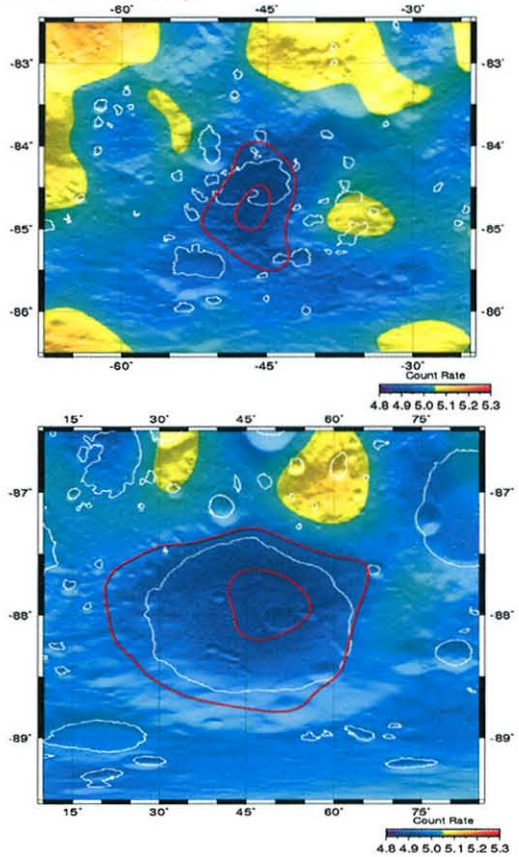
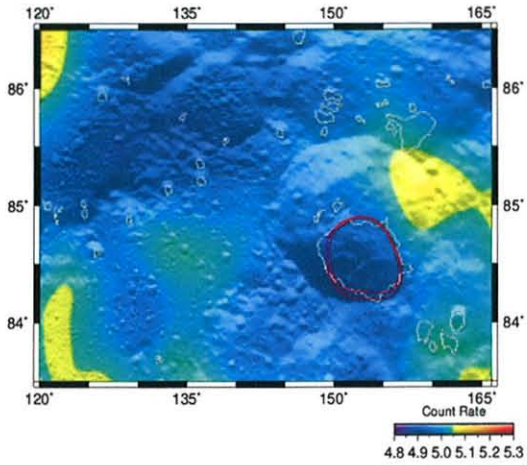


Figure 1: LEND maps of epithermal neutrons for *Cabeus* (*top*), *Shoemaker* (*middle*) and at *Rozhdestvensky* (*bottom*) craters. Shades of blue corresponds to epithermal neutron flux. The boundaries of NSRs and PSRs are shown by red and white contours, respectively. Surface relief is shown by gray shadows derived from LOLA altimetry.


120°
135°
150°
165°
86°
85°
84°
Count Rate
4.8 4.9 5.0 5.1 5.2 5.3